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Taxonomic notes on the Celastraceae of Sabah and Sarawak

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Summary. Two new species and two new varieties of *Kokoona*, and six new species and one new variety of *Microtropis*, from Sabah and Sarawak, are described. *Microtropis borneensis* Merr. is reinstated as a distinct species.

In the course of studying the Celastraceae for the Tree Flora of Sabah and Sarawak Project, several new taxa have been recognised. These include two new species of *Kokoona* known from Sabah, apparently rather rare, and two new varieties in the same genus from Sarawak, which are probably of very localised distribution. Also, in *Microtropis*, five species from Sarawak and two from Sabah have been found to be new. Evidence for the reinstatement of *Microtropis borneensis* Merr., previously considered a synonym of *M. platyphylla* Merr., is provided.

Kokoona leucoclada *Kochummen* **sp. nov.** *species ramulis albis et fructibus pustulis magnis obsitis distinctissima. Typus: Amin & Francis SAN 129399, Sabah, Ranau (holotypus SAN; isotypi K, L).* (Fig. 1)

Medium to large-sized tree to 35 m tall, 20 cm diameter. Bark grey, smooth; inner bark pale brown. Sapwood ochre. Twigs whitish, youngest flattened with longitudinal median grooves. Leaves leathery, drying to grey brown, elliptic to oblong, 16.5–20 cm x 6.5–10 cm; base cuneate, margin faintly wavy, slightly recurved, apex pointed; midrib raised above, keeled below; lateral veins 10–12 pairs, visible on both surfaces, distinctly looping near margin; intercostal veins reticulate, very faint; petiole 1–1.5 cm long. Inflorescences axillary, to 14 cm long, rachis rectangular, greyish. Flowers (immature) sessile, subtended by 5 bracteoles. Fruit 16 cm x 6 cm, with large pustules outside, on a 20-cm long stalk. Seeds 12 cm x 2.5 cm.

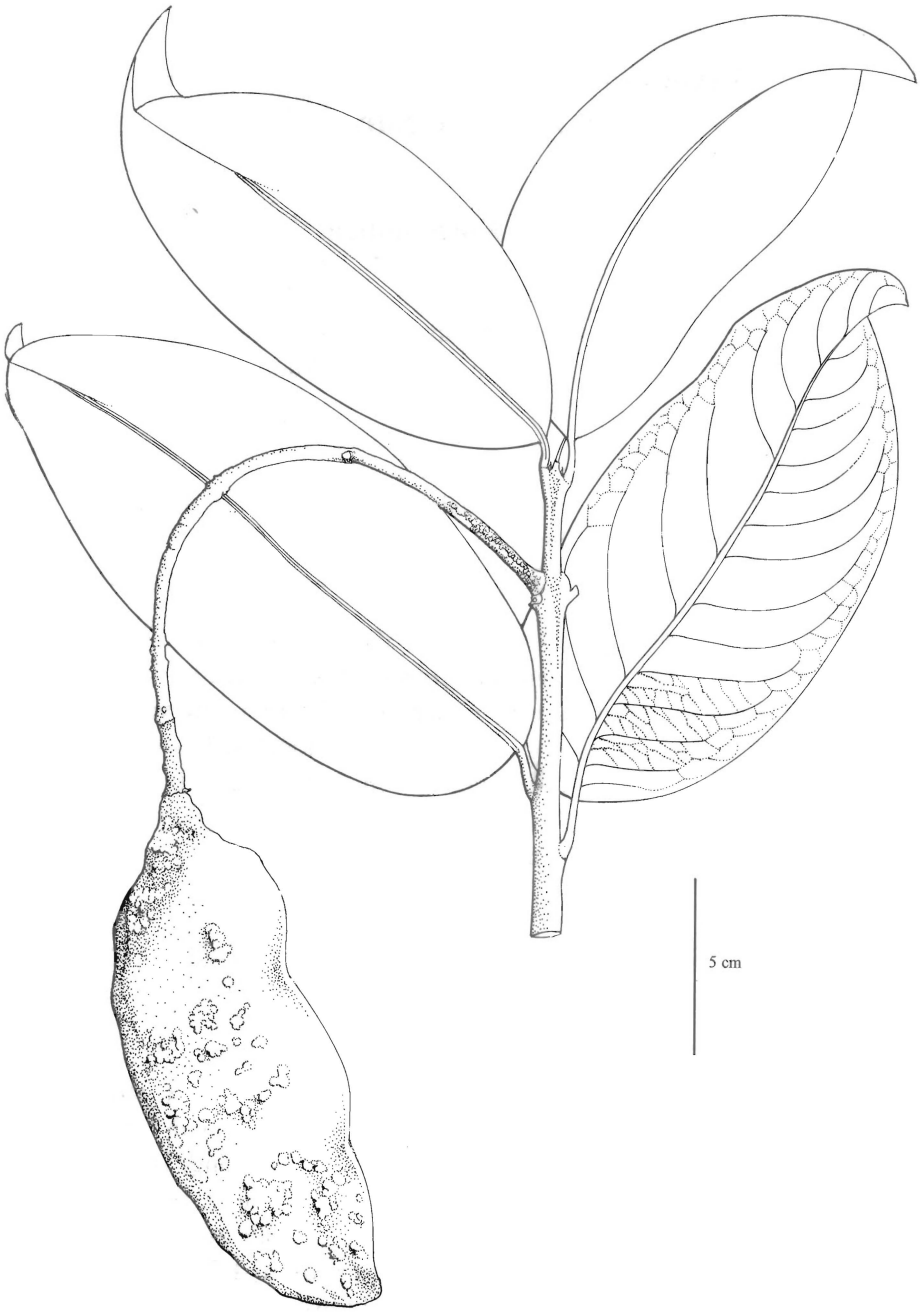

Fig. 1. *Kokoona leucoclada*, fruiting branch (from *Amin & Francis* SAN 129399).

DISTRIBUTION. Endemic to Sabah. Very rare, and known only from two collections, *Amin & Francis* SAN 129399 (type) from Ranau and *Hepburn, Fox & Meijer* SAN 61073 from Sandakan.

ECOLOGY. Lowland forest.

The whitish twigs, which when young are flattened and with longitudinal median grooves, and the faintly wavy leaf margin, are distinctive.

Kokoona littoralis *Laws. var.* **bakoensis** *Kochummen* **var. nov.** *a var. littorale foliis crasse coriaceis apice rotundatis vel obtusis venatione obscura differt. Typus: Ding Hou 534, Sarawak, Kuching (holotypus SAR; isotypus L).*

Small pole-sized tree to 6 m tall and 2 cm diameter. Leaves coriaceous, oblong with rounded or blunt apices, 5–11 cm x 1.5–4 cm; lateral and intercostal veins indistinct.

DISTRIBUTION. Locally frequent, known only from Bako National Park, Sarawak.

ECOLOGY. Heath forests.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Kuching, Bako National Park, *Ding Hou* 534 (holotype SAR, isotype L). Near Bkt. Tampi, *Brunig* S. 9537 (SAR), S. 9539 (SAR). Lintang Path *Ilias* S. 17893 (A, K, L, SAN, SAR, SING). Top of Tg. Sapi, *Brunig* S. 9540 (SAR), *Mamit* S. 34393 (B, K, KEP, L, SAN, SAR). Telok Paku, *Chai & Ilias* S. 17851 (A, BO, K, KEP, L, MEL, SAN, SAR, SING). Telok Pandan Besar, *Lee* S. 40681 (K, KEP, L, MO, SAN, SAR), *Awa & Ismawi* S. 47055 (K, KEP, L, MO, SAN, SAR).

The coriaceous leaves, with rounded or blunt apices and indistinct venation, distinguish this from *K. littoralis* var. *littoralis*.

Kokoona littoralis *Laws. var.* **longifolia** *Kochummen* **var. nov.** *a var. littorali foliis permagnis (20 cm x 6.5 cm) in sicco marginibus roseis differt. Typus: Wright & Ismawi S. 32289, Sarawak, Limbang (holotypus SAR; isotypi K, SAN).*

Small tree to 18 m tall, 17 cm diameter. Bark greyish, smooth to scaly. Leaves thick leathery, elliptic to lanceolate, 20 cm x 6.5 cm; petiole 2 cm long, channeled above; base cuneate, margin pinkish, apex pointed; midrib raised above; lateral veins 7–9 pairs, faint on both surfaces, intercostal veins laxly reticulate, very faint.

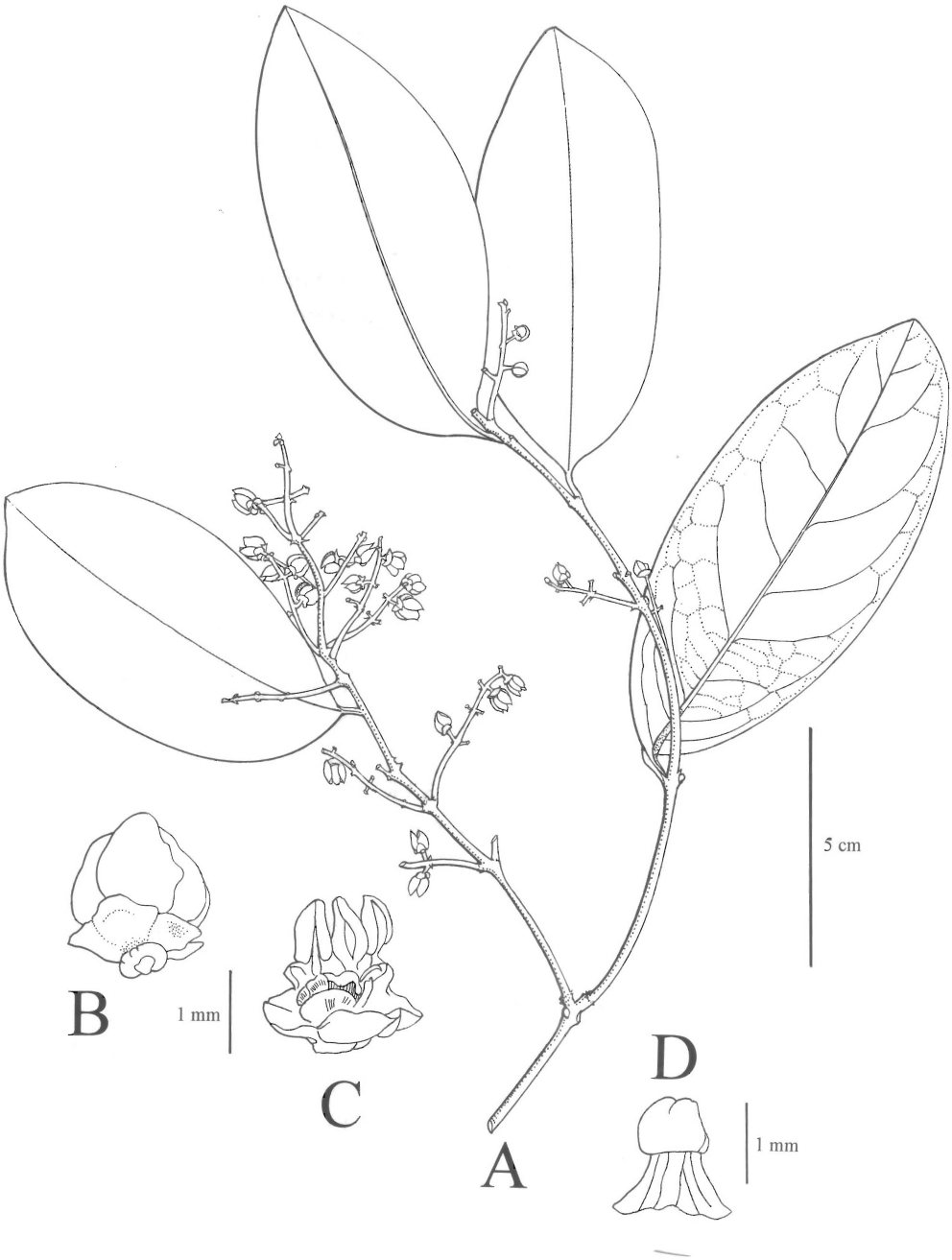

Fig. 2. *Kokoona sabahana*. **A.** Flowering branch. **B.** Flower. **C.** Flower with petals and pistil removed, showing stamens and disc. **D.** Apical part of pistil. All from *Asik* SAN 129928.

DISTRIBUTION. Very rare, known by a single collection, *Wright & Ismawi* S. 32289, from Limbang, Sarawak.

ECOLOGY. Lowland forest.

The larger leaves, which dry with a pinkish margin, distinguish this from *K. littoralis* var. *littoralis*.

Kokoona sabahana *Kochummen* **sp. nov.** *species K. ovatolanceolata affinis sed paniculis brevibus minus ramosis, floribus majoribus, stigmate papilloso et petiolis brevioribus distinguenda. Typus: Asik Mantor SAN 129928, Sabah, Nabawan (holotypus SAN).* (Fig. 2)

Small tree to 12 m tall, 10 cm diameter. Bark pale grey; inner bark brownish. Sapwood yellowish. Twigs dark brown to black, swollen at the nodes. Leaves elliptic to oblong, 7–11 cm x 4–6 cm, drying shiny yellowish brown; base broadly cuneate, margin entire or slightly wavy, apex pointed or blunt; midrib very faintly visible above; lateral veins 6–7 pairs, looping near margin, visible below, faint above; intercostal veins reticulate, faintly visible below; petiole 5–7 mm long, channeled above. Inflorescence an axillary or terminal panicle, up to 6 cm long, with a few branches. Flowers 5-merous; buds subglobose, 3 mm across; pedicel 2 mm long, articulated; sepals triangular; petals slightly obovate with pale margin; disc 5-lobed; stamens inserted within the disc, filaments broad and flat below, tapering towards the apex, anthers without protruding connectives; ovary immersed in disc, style distinct, stigma capitate, with papillae at the top. Fruits unknown.

DISTRIBUTION. Endemic to Borneo. Rare, known only from three collections from Sabah.

ECOLOGY. Lowland (including swamp) to hill forests to 600 m.

SPECIMENS EXAMINED—BORNEO. SABAH: Labou Forest Reserve, Nabawan, *Asik Mantor*, SAN 129928 (holotype SAN; isotypes A, BO, K, L, OX, SAR, SING). 1 mile north of Sapi Camp, Sandakan, *Meijer* SAN 43778 (SAN). Mt. Wullersdorf, 600 m altitude, Tatau, *Pitty Binideh* SAN 61465 (SAN).

The species is related to *K. ovatolanceolata* but differs from it by its anthers which do not have protruding connectives, and its apically papillose stigmas.

Microtropis argentea *Kochummen* **sp. nov**. *species foliis crasse coriaceis subtus in sicco griseis marginibus incrassatis recurvatis supra venatione leviter impressa distincta, petala plus quam dimidio connata. Typus: Lee S. 39980, Sarawak, 7th Division, Belaga (holotypus SAR; isotypi K, KEP, L, SAN).* (Fig. 3)

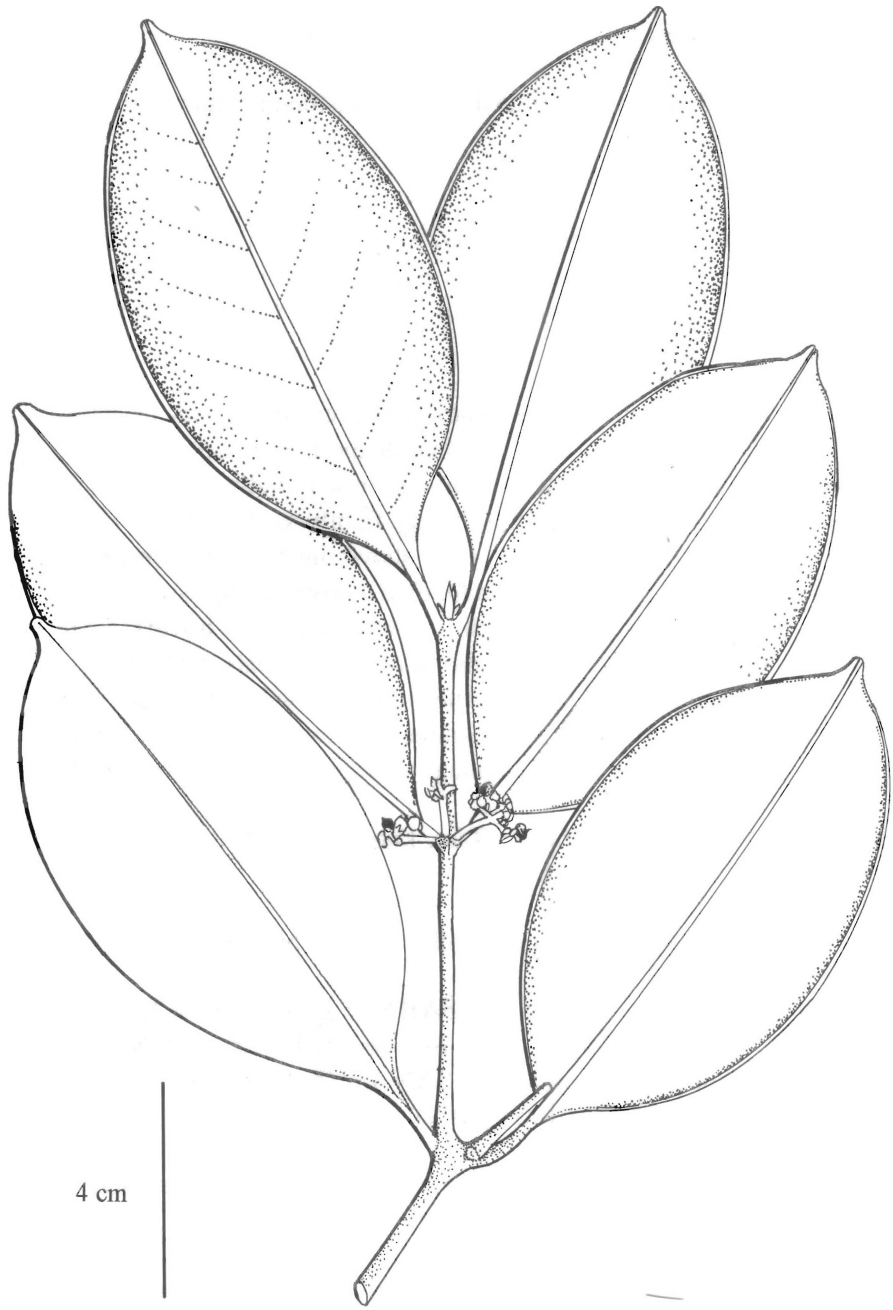

Fig. 3. *Microtropis argentea*, flowering branch (from *Lee* S. 39980).

Small tree to 5 m tall. Incipient bracts lanceolate, stiff, brown, 5 mm long. Twigs swollen at nodes, grey, terete. Leaves thickly leathery, drying to pale green above, greyish below, elliptic, 10.5–12 cm x 5.5 cm; base cuneate; margin prominently recurved, with thick rim; apex shortly pointed, incurved; midrib prominently raised above; lateral veins 6–7 pairs, invisible below, faintly sunken above; intercostal veins invisible below, reticulate and faintly sunken above; petiole 0.7–1 cm long, wrinkled on drying. Inflorescences in 1.5–cm long cymes; peduncles *c.* 1 cm long; buds globose, 2 mm across. Flowers white, 5-merous; sepals rounded with erose margins, wrinkled outside; petals united to more than half the length, lobes oblong; stamens at mouth of corolla tube, filaments very short, anthers globose; ovary conical, apical part ridged with no distinct style or stigma. Fruit unknown.

DISTRIBUTION. Endemic to Borneo. Very rare, known only from the type specimen from Belaga, Sarawak.

ECOLOGY. *Kerangas* forest on plateau at 700 m.

The leaves, which dry grey on the lower side and have recurved margins and impressed lateral veins on the upper side, and the petals, which are united for more than half the length, make this species distinctive.

Microtropis fascicularis *Kochummen* **sp. nov**. *ab omnibus speciebus microtropidis floribus in fasciculis sessilibus distinguenda. Typus: Lee S. 44277, Sarawak, 2nd Division, Lingga, Gunong Lesong (holotypus SAR; isotypi A, K, KEP, L, SAN).* (Fig. 4)

Treelet to 2 m tall. Incipient bracts stiff, brown, lanceolate, 7 mm x 1 mm, with sharp tip. Twigs dark brown, rounded. Leaves leathery, surface not papillose nor pustulate, elliptic or oblong, 10.5–20.5 cm x 4–8.5 cm; base cuneate; margin slightly recurved; apex pointed; midrib raised above; lateral veins 10–12 pairs, looping near margin, very faint on both surfaces; intercostal veins reticulate, very close, visible on both surfaces; petiole 0.5–2.2 cm long, wrinkled on drying. Flowers in sessile fascicles, 4-merous; sepals rotund, margin erose, 2 mm x 1.5 mm; petals free, oblong to obovate, 1.5 mm x 1.2 mm; stamens free, anthers oblong, 1 mm long; ovary gradually tapered towards apex, striate, stigma 4-lobed. Fruits green when fresh, drying black, oblong or ellipsoid, 15–18 mm x 4–6 mm, with pointed tip.

DISTRIBUTION. Endemic to Borneo. Rare, known by five collections from Sarawak.

ECOLOGY. Mixed dipterocarp forest including *kerangas* forest to 500 m, usually by streams. Flowers collected in December and fruits from March to May.

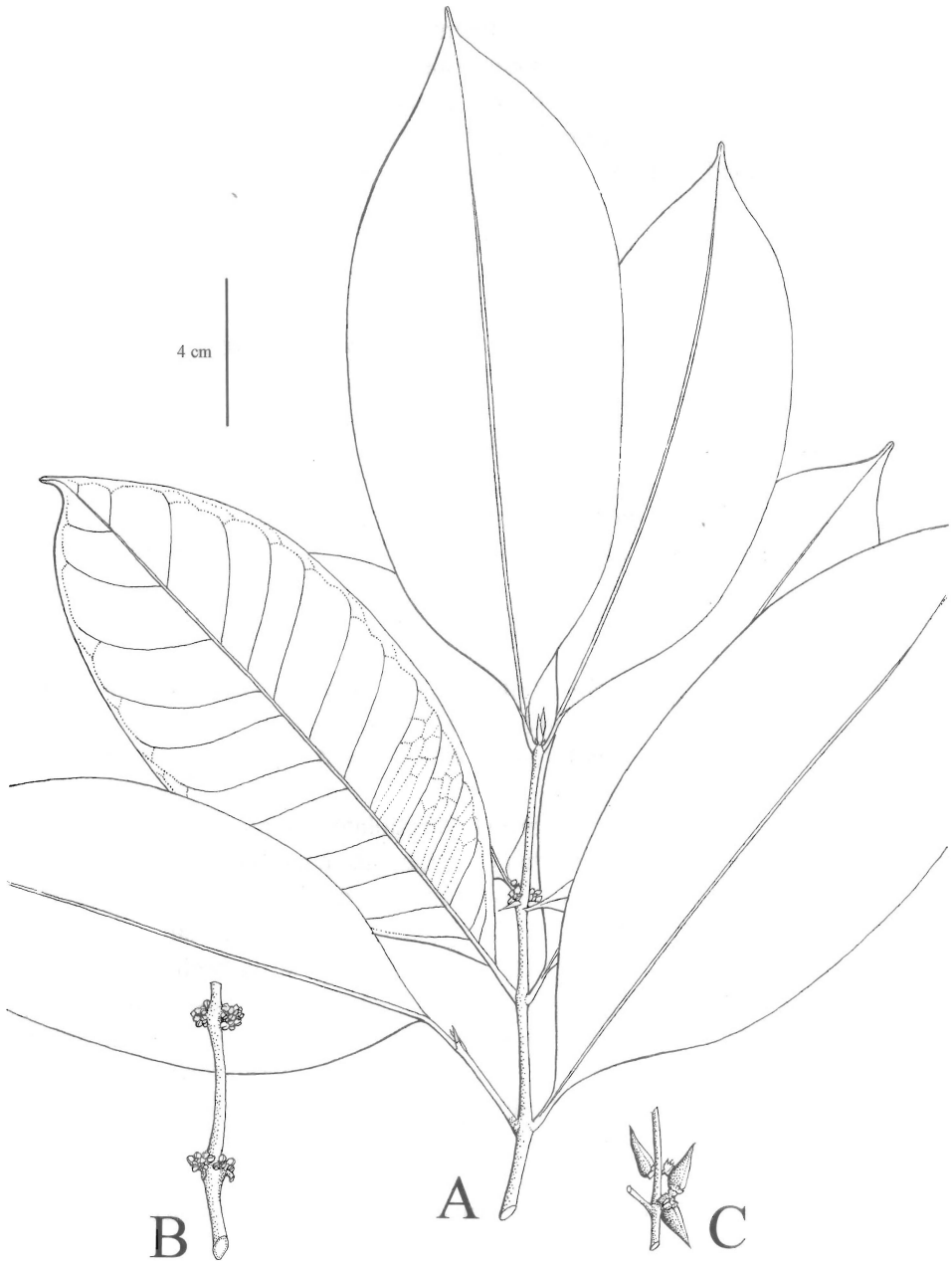

Fig. 4. *Microtropis fascicularis.* **A.** Flowering leafy branch. **B.** Flower clusters. **C.** Fruits. **A** and **B** from *Lee* S. 44277, **C** from *Martin & Ismawi* S. 36677.

SPECIMENS EXAMINED—BORNEO. SARAWAK: 1st Division, Gunung Buri, *Yii* S. 44187 (K, KEP, L, SAN, SAR). 1st and 2nd Division boundary, 7th Mile, Gunung Buri, *Martin & Ismawi* S. 36677 (L, K, KEP, MO, SAN, SAR). 1st Division, Datu P.F., *Lee* S. 41915 (K, KEP, L, MO, SAN, SAR). 1st Division, Proposed Matang National Park, Sg. Sendok, *Lee* S. 53885 (K, KEP, L, MO, SAN, SAR). 2nd Division, Lingga, Gunong Lesong, *Lee* S. 44277 (holotype SAR; isotypes A, K, KEP, L, SAN).

The sessile fascicles of flowers are distinctive of this species.

Microtropis grandifolia *Kochummen* **sp. nov**. *species bracteis incipientibus magnis (1.7–3 cm x 1.2–2 cm) ovatis vel ellipticis, foliis magnis (20–30 cm x 8.5–14.5 cm), petiolis longis (2.3–6 cm) distincta. Typus: Awa & Ilias S. 47380, Sarawak, 1st Division, Lundu, Bukit Panjo (holotypus KEP; isotypi K, SAR).* (Fig. 5)

Small tree to 5 m tall. Twigs brownish, youngest ones flattened. Incipient bracts conspicuous, foliaceous, ovate to elliptic, 1.7–3 cm x 1.2–2 cm. Leaves thinly to thickly leathery, elliptic, drying greenish brown on both surfaces, 20–30 cm x 8.5–14.5 cm; base broadly cuneate; margin faintly wavy, faintly curled inwards; apex pointed; midrib flattened to raised above; lateral veins 10–12 pairs, looping near margin, faintly raised on both surfaces with short intermediate veins; intercostal veins reticulate, faintly visible above; petiole 2.3–6 cm long, wrinkled on drying. Inflorescences 6–7-cm long paniculate cymes; peduncle 2–3 cm long; bracteoles triangular, transparent. Flowers 4-merous; outer two sepals larger than inner 2, rotund; petals slightly united at base; anthers sessile, jointed at base on a staminal ring, connective slightly prolonged; ovary flask-shaped, style ridged, stigma 2–4-lobed. Fruit unknown.

DISTRIBUTION. Endemic to Borneo. Very rare, known only by two collections *Awa & Ilias* S. 47380 from Bukit Panjo, Lundu, and *Chai* S. 34033 from Lubok Antu, Sarawak.

ECOLOGY. Lowland and hill forests to 600 m. Flowering samples collected in May.

The conspicuous foliaceous incipient bracts on the twigs, large long-stalked leaves, and 4-merous flowers with flask-shaped ovaries are diagnostic characters for this species.

Microtropis grandifolia *Kochummen var.* **longipetiolata** *Kochummen* **var. nov.** *a var. grandifolia foliis crasse coriaceis marginibus valde recurvatis, petiolis longioribus (6 cm) et stigmate 2-lobato differt. Typus: Chai S. 34033, Sarawak, Lanjak-Entimau P.F., Sg. Jelok near Bukit Sengkajang, Lubok Antu (holotypus SAR; isotypi K, KEP,L, MO, SAN).*

This variety is distinctive by its thickly leathery leaves, strongly incurved margin, *c.* 6 cm-long petiole and 2-lobed stigma.

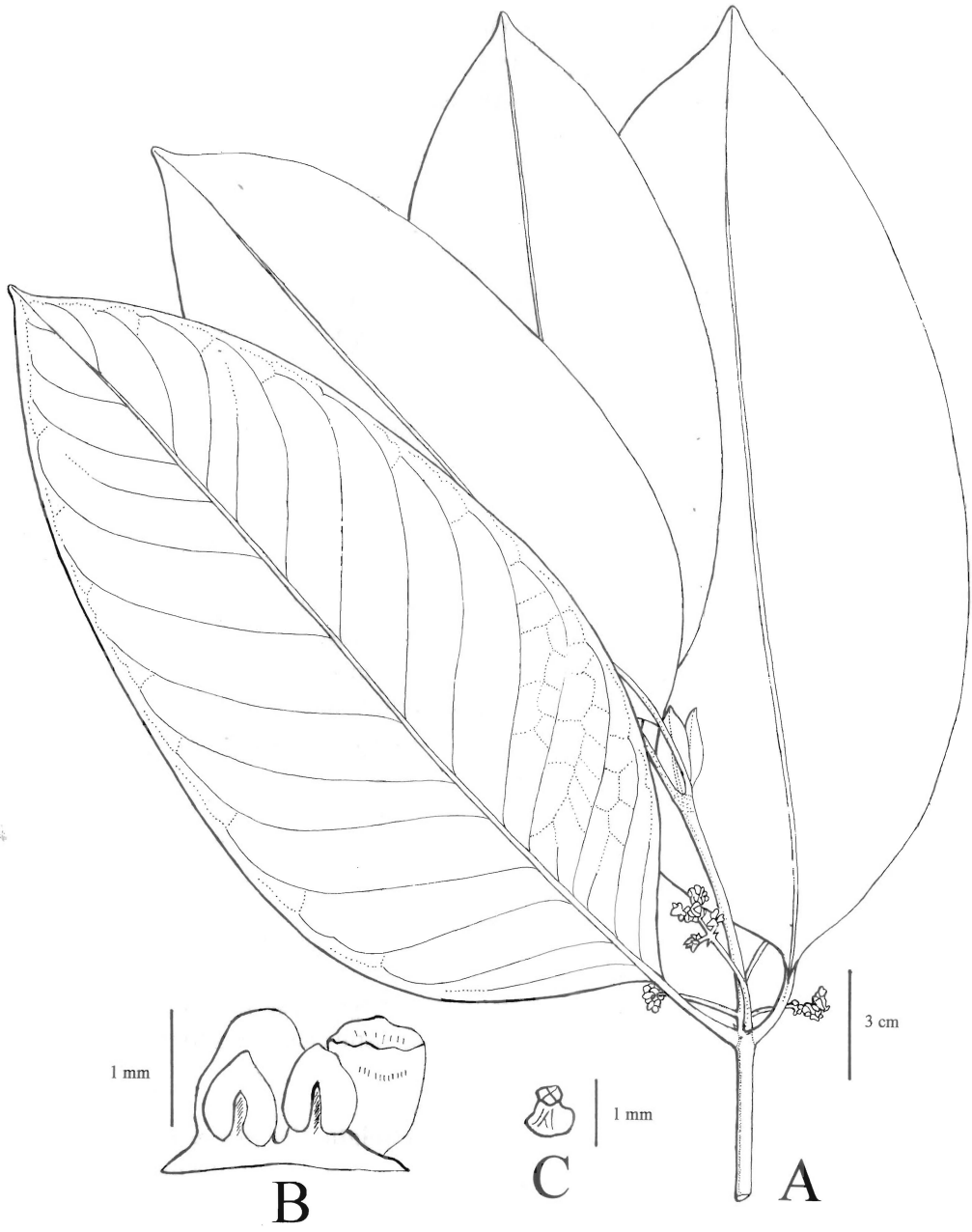

Fig. 5. *Microtropis grandifolia.* **A.** Flowering leafy branch. **B.** Two petals and two stamens. **C.** Pistil. All from *Awa & Ilias* S. 47380.

Microtropis keningauensis *Kochummen* **sp. nov**. *species foliis uniformiter papillosis subtus pustulis dispersis obsitis distincta. Typus: Fidilis SAN 118405, Sabah, Keningau (holotypus SAN; isotypi A, BO, K, KEP, L, OX, PNH. SAR, SING).* (Fig. 6)

Shrub or small tree. Twigs grey brown. Incipient bracts brown, lanceolate, 10 mm x 2 mm, with distinct median ridge. Leaves leathery, drying brownish, uniformly papillose below with scattered pustules, elliptic, 11.5–23.5 cm x 4.5–8.5 cm; base cuneate; margin not curled inwards; apex pointed; midrib flattened above; lateral veins 9–12 pairs, looping near margin, distinct below, faintly visible above; intercostal veins reticulate, distinct below, almost invisible above; petiole 8–15 mm long, drying black. Inflorescences and flowers unknown. Infructescences almost sessile, to 1-cm-stalked. Fruits yellowish green when fresh, black on drying, oblong, 2–2.3 cm x 0.7–0.8 cm, apex pointed.

DISTRIBUTION. Endemic to Borneo. Very rare, known by two collections only, *Fidilis* SAN 118364 (A, BO, K, KEP, L, OX, PNH, SAN, SAR, SING) and *Fidilis* SAN 118405 (the type) from Lanas, Keningau in Sabah.

ECOLOGY. Lowland forest by streams and ridge tops. Fruits collected in October.

The distinctive characters of the species are the uniformly papillose lower leaf surface and the distinct median ridges of the incipient bracts on the twigs.

Microtropis sabahensis *Kochummen* **sp. nov**. *M. kinabaluensis arcte affinis sed petalis connatis, forma ovarii et stigmate prominenti differt. Typus: Banang SAN 51915, Sabah, Kinabatangan, Lamag (holotypus KEP; isotypus SAN).* (Fig. 7)

Treelet to 5 m tall. Youngest twigs reddish brown. Incipient bracts greenish, needle-like, 5 mm x 1 mm. Leaves thinly leathery, elliptic, 13.5–20.5 cm x 3.5–7 cm; base cuneate; margin slightly wavy; midrib raised above; lateral veins 8–10 pairs, looping and joining near margin, faint on both surfaces; intercostal veins reticulate, very faint; petiole 1–1.5 cm long, drying greenish yellow. Inflorescences axillary, 3–4.5 cm long, cymose panicles, peduncle 1–1.5 cm long; bracteoles triangular, transparent. Flowers 4-merous; sepals ovate, transparent, wrinkled outside; petals united half-way, lobes oblong with transparent margins; stamens seated on the mouth of corolla tube, filaments flat; ovary gradually tapered towards apex, slightly ridged towards apex, style indistinct, stigma distinct, 4-lobed. Fruits unknown.

DISTRIBUTION. Endemic to Borneo. Very rare, known from the type collection, *Banang* SAN 51915 from Kinabatangan, Sabah.

ECOLOGY. Lowland and seasonal swamp forests. Flowering in June.

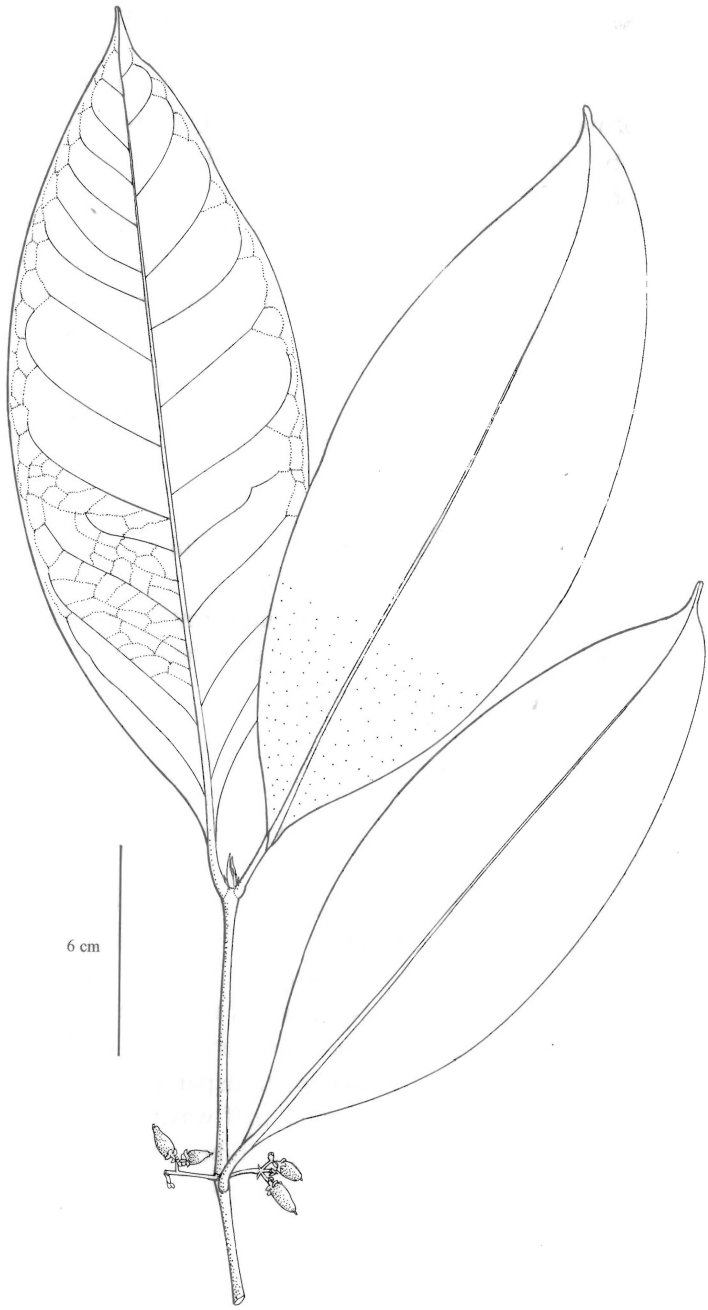

Fig. 6. *Microtropis keningauensis*, fruiting leafy branch (from *Fidilis* SAN 118405).

This species is related to *M. kinabaluensis* but differs by its connate petals, apically tapered ovary and prominent stigma.

Microtropis sarawakensis *Kochummen* **sp. nov**. *species M. sabahensis foliorum characteribus similis sed forma magnitudineque incipientium bractearum, petalis libris et stigmate non lobato differt. Typus: Ilias S. 36501, Sarawak, Gunung Mulu National Park, near foot of Gunong Api (holotypus KEP; isotypi K, L, MO, SAN, SAR).* (Fig. 8)

Small tree to 5 m tall, 8 cm diameter. Incipient bracts green, elliptic to lanceolate, 10 mm x 4 mm. Twigs reddish brown, rounded, youngest ones angular. Leaves thinly leathery, drying to greenish yellow, elliptic or oblong, 10–17 cm x 7.5 cm; base cuneate; margin wavy and slightly recurved; apex pointed; midrib raised above; lateral veins 7–9 pairs, very faint on both surfaces; intercostal veins invisible to very faint; petiole 1–1.5 cm long, channeled above, wrinkled and yellowish on drying. Inflorescences cymose panicles, 2–5 cm long, peduncle 1–1.5 cm long. Flowers 4- or 5-merous; calyx lobes suborbicular, transparent with few fine veins in the middle; petals free, imbricate, oblong, transparent; stamens with short filaments which are joined at the bottom by a staminal ring, connective slightly prolonged; ovary short conical, without distinct style, with wavy-surfaced, unlobed stigma. Fruits (immature) green when fresh, ovoid, 7–10 mm x 4–5 mm, apex with short style and stigma, calyx persistent.

DISTRIBUTION. Endemic to Borneo. Rare, recorded from Sarawak only.

ECOLOGY. Lowland forests by streams. Flowers collected in April and June and fruits in October.

SPECIMENS EXAMINED—BORNEO. SARAWAK: 4th Division, Ulu Dapoi, Tingar Marudi, *Ilias* S. 23079 (A, BO, K, KEP, L, MEL, MOSC, SAN, SAR, SING). 4th Division, Ulu Sg. Melinau, Gunung Mulu National Park, Near foot of Gunung Api, *Ilias* S. 36501 (holotype KEP, isotypes K, L, MO, SAN, SAR). 5th Division, Ulu Lawas, Sg. Kenaya near suspension bridge, *Chai & Ilias* S. 31148 (A, BO, K, L, SAN, SAR, SING).

Related to *M. sabahensis*, this species is, however, distinct by its conspicuous, elliptic to lanceolate incipient bracts on the twigs, free petals and unlobed stigma.

Reinstatement of *Microtropis borneensis* Merr.

In his treatment of the Celastraceae for the Flora Malesiana, Hou (1962) considered *M. borneensis* Merr. a synonym of *M. platyphylla* Merr.

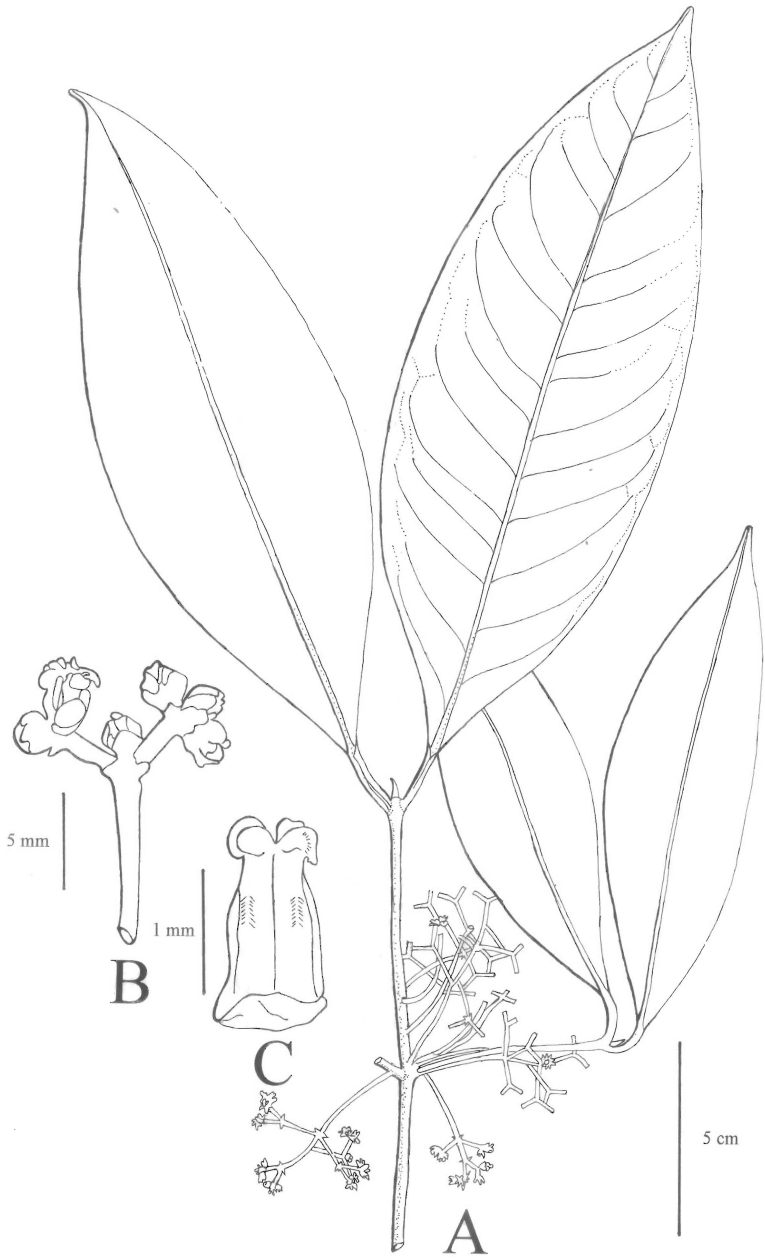

Fig. 7. *Microtropis sabahensis.* **A.** Flowering leafy branch. **B.** Part of inflorescence. **C.** Pistil. All from *Banang* SAN 51915.

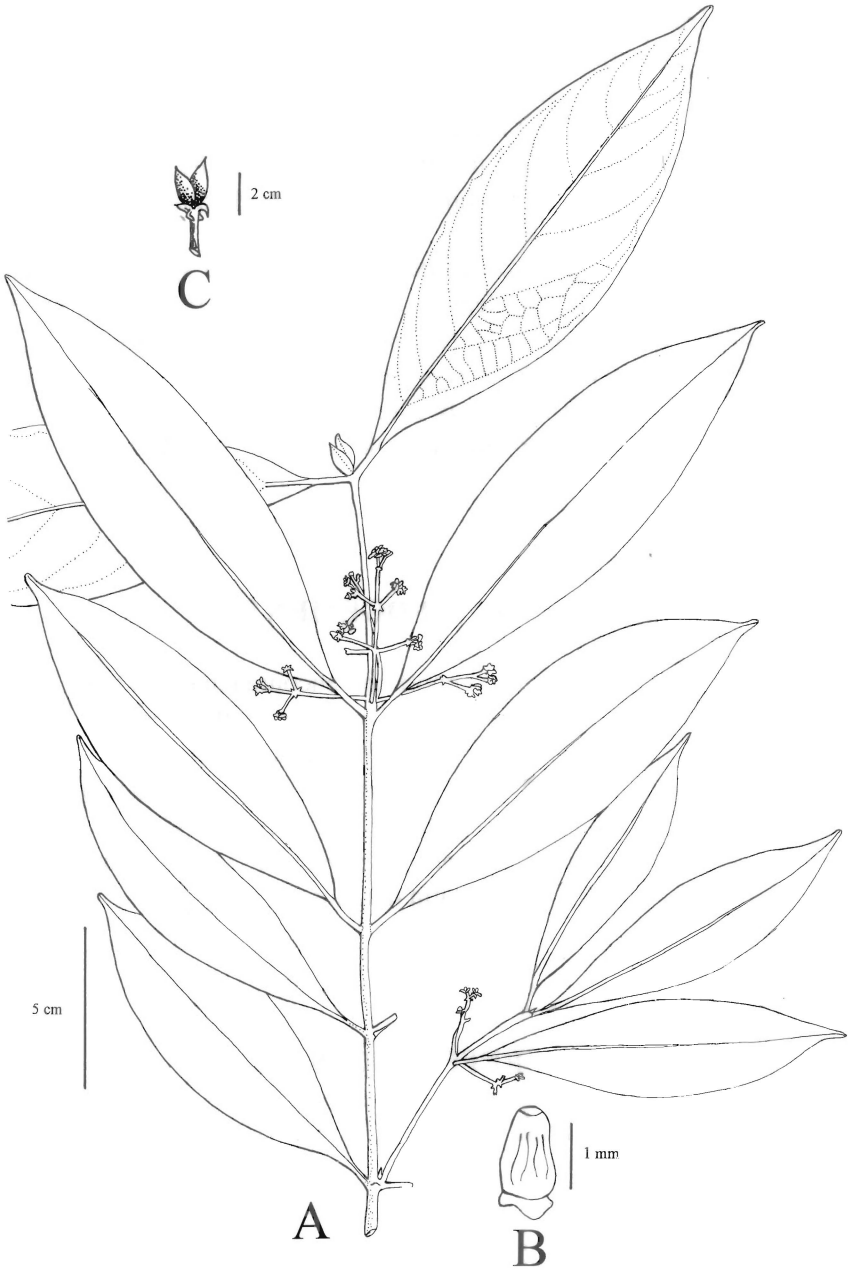

Fig. 8. *Microtropis sarawakensis*. **A.** Flowering leafy branch. **B.** Pistil. **C.** Fruits. **A** and **B** from *Ilias* S. 36501, **C** from *Chai & Ilias* S. 31148.

The type of *M. platyphylla* is *Loher* 5799 from the Philippines. It has larger leaves (18–22 cm long) with 10–12 pairs of lateral veins which are distinct on the lower surface, and the intercostal veins are close together, fine, and distinct. The leaf margin is not conspicuously recurved in this specimen. The calyx lobes of the flower are orbicular. The type of *M. borneensis* is *J & M.S. Clemens* 31742 from Mount Kinabalu in Sabah, collected at 3000 m. It has smaller leaves (5–8 cm long) with 5–7 pairs of faint lateral veins, and the intercostal veins are invisible. In addition, the leaf margin is strongly recurved. The calyx lobes of the flower are ovate and not orbicular.

Thus, there are considerable differences between these two species, especially in the texture, margin and venation of the leaves, even though there is inadequate flowering material representing *M. borneensis*. *M. borneensis* Merr. should therefore be considered distinct from *M. platyphylla* Merr. *Rena George* S. 40412 from the Bukit Lambir National Park in Sarawak (collected in *kerangas* forest at 600 m altitude) represents a new distributional record of *M. borneensis* in Sarawak.

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